WSGR Wilson Sonsini Goodrich & Rosati
PROFESSIONAL CORPORATION

Date: January 7, 2004

To: Examiner Parviz Hassanzadeh, Unit 1763 **Fax:** 703-872-9306 ☐ Use this fax number only

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Message:

In re Application of

Stephen E. Savas
Application No.: 10/053,138
Filed: 01/18/2002
For: Pulsed Plasma Processing of Semiconductor Substrates

Group Art Unit: 1763
Examiner: Parviz Hassanzadeh

Please see attached Transmittal, Fee Transmittal, and Response to Office Action in the above-referenced matter.

Ref: 14912.786 Return Original to: Linda Faye Location: SR 1-2-i

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PTO/SB/21 (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

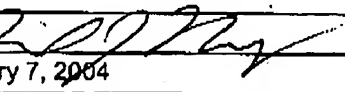
TRANSMITTAL FORM (to be used for all correspondence after initial filing)			
		Application Number	10/053,138
		Filing Date	January 18, 2002
		First Named Inventor	Stephen E. Savas
		Art	1763
		Examiner	Parviz Hassanzadeh
Total Number of Pages in This Submission	7	Attorney Docket Number	14912.786

ENCLOSURES *(Check all that apply)*

- ☒ Fee Transmittal Form
- ☐ Fee Attached
- ☒ Amendment/Reply
- ☐ After Final
- ☐ Affidavits/declaration(s)
- ☒ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Response to Missing Parts/ Incomplete Application
- ☐ Response to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
- ☐ After Allowance Communication to Group
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to Group (Appeal Notice, Brief, Reply Brief)
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) (please identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual	Michael J. Murphy, Reg. No. 37,404; Customer No. 21971
Signature	
Date	January 7, 2004

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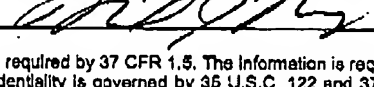
Signature		Date	January 7, 2004

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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FEE TRANSMITTAL for FY 2004

Patent fees are subject to annual revision.
Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12. See 37 C.F.R. §§ 1.27 and 1.28.

TOTAL AMOUNT OF PAYMENT	(S) 950

Complete if Known	
Application Number	10/053,138
Filing Date	Jan. 18, 2002
First Named Inventor	Stephen E. Savas
Examiner Name	Parviz Hassanzadeh
Group/Art Unit	1763
Attorney Docket Number	14912.786

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 23-2415 (Docket No. 14912.786)

Deposit Account Name: Wilson Sonsini Goodrich & Rosati

☒ Charge Any Additional Fee Required Under 37 CFR §§ 1.16 and 1.17

2. ☐ Payment Enclosed:

☐ Check ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Fee Code	Large Entity Fee ($)	Small Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	770	201	385	Utility filing fee	
106	340	206	170	Design filing fee	
107	530	207	265	Plant filing fee	
108	770	208	385	Reissue filing fee	
114	160	214	80	Provisional filing fee	

SUBTOTAL (1) (S) 0

2. EXTRA CLAIM FEES

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		x		=	
Independent Claims		-3** =		x		=	
Multiple Dependent						=	

***or number previously paid, if greater; For Reissues, see below*

Large Fee Code	Large Entity Fee ($)	Small Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	86	202	43	Independent claims in excess of 3
104	290	204	145	Multiple dependent claim, if not paid
109	86	209	43	**Reissue independent claims over original patent
110	18	210	9	**Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) (S)0

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Fee Code	Large Entity Fee ($)	Small Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	420	216	210	Extension for reply within second month	
117	950	217	475	Extension for reply within third month	950
118	1,480	218	740	Extension for reply within fourth month	
128	2,010	228	1,005	Extension for reply within fifth month	
119	330	219	165	Notice of Appeal	
120	330	220	165	Filing a brief in support of an appeal	
121	290	221	145	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,330	241	665	Petition to revive - unintentional	
142	1,330	242	665	Utility issue fee (or reissue)	
143	480	243	240	Design issue fee	
144	640	244	320	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	770	246	385	Filing a submission after final rejection (37 CFR 1.129(a))	
149	770	249	385	For each additional invention to be examined (37 CFR 1.129(b))	
Other fee (specify)					
Other fee (specify)			55/110	Terminal Disclaimer	

* Reduced by Basic Filing Fee Paid SUBTOTAL (3) $950

SUBMITTED BY

Name (Print/Type)	Michael J. Murphy	Registration No. (Attorney/Agent)	37,404	Telephone	650-493-9300
Signature		Date	January 7, 2004	Customer No. 021971	

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Attorney Docket No. 14912.786

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of)
)
Stephen E. Savas) Group Art Unit: 1763
)
Application No.: 10/053,138) Examiner: Parviz Hassanzadeh
)
Filed: 01/18/2002)
)
For: Pulsed Plasma Processing of Semiconductor)
Substrates)

Response to Office Action

Mail Stop: Amendment
Commissioner for Patents
PO Box 1450
Alexandria VA 22313-1450

Sir:

In an office action dated July 7, 2003, the Examiner rejected pending claims 44-82. The Examiner rejected claims 44-56 and 60-63 under 103(a) as being unpatentable over U.S. Patent 5,289,010 ("Shohet") in view of WO 91/10341 ("Savas") and rejected claims 57-59 and 64-82 under 103(a) as being unpatentable over Shohet in view of Savas and further in view of U.S. Patent 4,858, 516 ("Corn"). In this response, applicant respectfully traverses the Examiner's rejection of pending claims 44-82.

Claims 44 and 64 are independent claims and claims 45-63 and claims 65-82 depend from those claims, respectively.

Claim 44 is directed at a method of plasma processing a semiconductor substrate comprising, among other things, inductively coupling power to a plasma using high power cycles and low power cycles such that greater than about 5kW of power is coupled to the plasma during each high power cycle; coupling power to a substrate support using high power cycles and low power cycles; and

synchronizing such that the high power cycles are applied to the substrate support substantially during the time that low power cycles are applied to the plasma.

Claim 64 is directed at a method of plasma processing a semiconductor substrate comprising, among other things, inductively coupling power to a plasma using high power cycles and low power cycles with a duty cycle of about 5 to 30 percent; coupling power to a substrate support using high power cycles and low power cycles; and synchronizing such that the high power cycles are applied to the substrate support substantially during the time that low power cycles are applied to the plasma.

In rejecting independent claims 44 and 64, the Examiner relies upon Shohet as teaching a plasma power source 36 modulated by a pulse modulator 38 such that "whereas as shown in Fig. 3, plasma excitation is on except during the time a pulsed voltage is applied to the substrate support".

Shohet describes a plasma source ion implantation process and apparatus. A plasma may be created by ionizing a neutral gas. However, unwanted species may also be ionized when generating the plasma. See col. 1, lines 65-67 and col. 2, lines 9-10 and 17-21. Shohet teaches the use of ion cyclotron resonance (ICR) in the presence of a magnetic field to purify the ions and drive unwanted ion species into resonance and into a collection plate or other collection means. See col. 2, lines 21-30. The frequency, magnetic field, electric field and other parameters are selected in relation to one another to achieve the desired resonance and resulting purification. See col. 4, lines 6-68 and col. 5, lines 1-24. In Figures 1 and 2 of Shohet, a magnet 22 provides a magnetic field between plate-like electrodes 17 and plates 19 to form the ICR system. This ICR system is separate from the plasma source 16 and plasma source power supply 36 used to ionize the gas.

Figure 3 in Shohet, referenced by the Examiner, illustrates acceleration pulses 61 applied to the target and the ICR excitation 64 and 69 which are applied to the excitation electrodes 17. See col. 7, lines 39-51. The ICR excitation signals 64 and 69 in Figure 3 are the signals used to purify ions after the plasma is generated and are not signals used to generate the plasma. See also col. 6, lines 14-20

(the plasma source 16 creates the plasma which drifts into the ion purification region and "Once the ions are in the ion purification region, the time varying electric field from the excitation electrode 17 serves to sweep out the undesired species").

While the ICR in Shohet applies an excitation signal to the plasma, it uses a magnet and plate-like electrodes (and the corresponding excitation signals in Figure 3 of Shohet) and does not teach or suggest inductively coupling power into the plasma in the manner set forth in independent claims 44 and 64 of the present application. Moreover, there is no suggestion to substitute the plasma source or power signals in Savas for the ICR purification in Shohet. Shohet teaches that the frequency, magnetic field, electric field and other parameters are selected in relation to one another to achieve the desired resonance. There is no teaching or suggestion to combine the higher power levels of Savas cited by the Examiner to the ion purification excitation signals in Figure 3 of Shohet. In addition, the plasma source in Savas does not purify ions for ion implantation as desired in Shohet and substituting it for the ICR in Shohet would render Shohet inoperable for its intended purpose. In addition, substituting the plasma source in Savas for the plasma source in Shohet also would not result in the claimed invention, because the excitation signals shown in Figure 3 do not apply to the power source (and, in any event, the plasma source of Savas does not use high and low power cycles of the type required by independent claims 44 and 64).

Corn also does not make up for the deficiencies in Shohet. Corn describes parallel plate electrodes which would capacitively (rather than inductively) couple power into a plasma. High and low frequency signals are applied to the electrodes for an etch process. Corn does not teach or suggest inductively coupling power into a reactor in the manner set forth in independent claims 44 and 64. In addition, there is no suggestion to combine the duty cycles used for the etch process in Corn with the ion implantation reactor described in Shohet. The ion implantation reactor uses high voltage

acceleration pulses to implant ions and does not use dual RF frequency signals of the type used for etching in Corn.

Methods using inductively coupled plasmas in accordance with the claimed invention can be used to provide important advantages by reducing charge build up and microsteering, a problem not recognized or addressed by the above references.

In view of the above, applicant believes that independent claims 44 and 64 are not anticipated or rendered obvious by Shohet either alone or in view of Savas and Corn. Therefore, claims 44 and 64 are believed to be patentable. Claims 45-63 and claims 65-82 depend from independent claims 44 and 64 and, as a result, are also believed to be patentable.

In view of the foregoing, it is believed that all of the pending claims are in condition for allowance. Applicant respectfully requests reconsideration, allowance and passage to issue of the claims as amended.

The Commissioner is authorized to charge any additional fees which may be required, including petition fees, or credit any overpayment to Deposit Account No. 23-2415 (Docket No. 14912-786).

Respectfully submitted,

WILSON SONSINI GOODRICH & ROSATI

Date: January 7, 2004

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